techniques using implicit shared computation have relied on properties of weight values that are independent of finite-precision numeric format.

In many signal processing transforms, a number may appear in several products. The weights of the number in each product may be known constants, or may vary. Even if there are no convenient special relationships among the number values of the weights, it is entirely possible that the representations of those number values in particular finite-precision numeric formats have common properties that allow shared calculations when computing products.

DESCRIPTION - THE PREFERRED EMBODIMENT

The preferred embodiment of the present invention is a machine used in computing one or more sums of products, as described in claim **1**. The preferred embodiment comprises a first real number in a first finite-precision numeric format, a second real number in a second finite-precision numeric format, and a third number in a third finite-precision numeric format.

The preferred embodiment has first real multiplier means for computing a first product equal to the product of the first real number and the second real number, as well as a set of intermediate terms. The preferred embodiment has second real multiplier means for computing a second product equal to the product of the first real number and the third real number. In computing the second product, the second real multiplier means uses one or more members of the set consisting of the first product and the first set of intermediate terms.

Because at least one computation result of the first real multiplier means is available to and used by the second real multiplier means, the preferred embodiment of the invention can lead to a lower cost of computing both products than would be possible if each product were computed separately.

In some ways, the invention is similar to the constant multiplier technique of US Patent 4,868,778 and US Patent 5,841,684. However, in each of those inventions, calculation results are shared within a multiplier that computes a single product of two numbers. In the present invention, at least one calculation result is shared between computation of different products.

The present invention is also similar in some ways to FFT techniques based on decomposition of large transforms into sets of smaller transforms. However, those FFT techniques rely on very specific relations between the number values of the transform weights. Likewise, fast techniques for other transforms such as the discrete cosine transform rely on particular relationships between the number values of transform weights.

In contrast to FFT and other fast techniques, the present invention does not require a signal processing transform having weights with particular relations among their number values. The present invention can exploit number values, but it can also exploit representations of number values in particular finite-precision numeric formats. The preferred embodiment, for instance, can exploit properties of the number values and representations of the second real number and the third real number to achieve low-complexity implementation of the multipliers.

The second real number and the third real number do not have to have the same finite-precision numeric format, although they could. For instance, the second real number might have a representation in a 16-bit twos complement format, while the third real number might have a representation in a 24-bit twos complement format. These finite-precision numeric formats are different, but the two number representations may have common patterns of bits.

The preferred embodiment of the invention according to claim **1** includes first real multiplier means and second real multiplier means. The invention can be applied to complex multiplication with complex numbers represented as pairs of real numbers. For

instance, the real numbers in claim **1** could be real or imaginary components of complex numbers represented in Cartesian coordinates.

DESCRIPTION - CLAIM 2 AND CLAIM 3

An alternative embodiment of the invention described in dependent machine claim **2** requires that the second real multiplier means of claim **1** not be able to compute the product of the first real number and the second real number. Another alternative embodiment of the invention described in claim **3** requires that the first real multiplier means not be able to compute the product of the first real number and the third real number.

The alternative embodiments of claims **2** and **3** reinforce that neither the first real multiplier means nor the second real multiplier means are required to be general multiplier means. One or both could be constant multipliers or non-constant, non-general multipliers. Multipliers that cannot compute the same products can share calculation results.

The invention could be applied to discrete Fourier transform computation after a fast Fourier transform technique has reduced the multiplication count from $O(N^2)$ to $O(N \log N)$ and after constant multipliers have been selected in order to reduce the cost of each multiplication. Suitable groups of two or more constant multipliers could share calculation results, thereby reducing the cost of computing the DFT below that of the FFT technique with separate constant multipliers.

DESCRIPTION - CLAIM 4

Dependent machine claim **4** requires that the second real multiplier means of claim **1** not use the first product in computing the second product. The second real multiplier means uses at least one member of the set of intermediate terms, however.